951

[P.]

THE

ART OF MAKING

FIREWORKS,

IMPROVED TO THE

MODERN PRACTICE;

FROM THE

MINUTEST TO THE HIGHEST BRANCHES:

CONTAINING

Plain and easy Directions for

Mixing and Preparing the Ingredients,

WITH INSTRUCTIONS FOR MAKING

SQUIBS, CRACKERS, SERPENTS, WHEELS,
ROMAN CANDLES, ROCKETS,

&c.

As also for some highly curious

AQUATIC FIREWORKS.

DERBY:
PUBLISHED BY THOMAS RICHARDSON;
SIMPKIN, MARSHALL, AND CO., LONDON;
S. HORSEY PORTSEA;
AND ALL OTHER BOOKSELLERS.
PRICE SIXPENCE.

59856/P

Suppl/P

ART
C

[c. 1840]

Air Balloon

Rockets

Guy Fawks

Cat and Wheel

Mermaid

THE

ART OF MAKING

FIREWORKS,

IMPROVED TO THE

MODERN PRACTICE;

FROM THE

MINUTEST TO THE HIGHEST BRANCHES:

CONTAINING

Plain and easy Directions for

Mixing and Preparing the Ingredients,

WITH INSTRUCTIONS FOR MAKING

SQUIBS, CRACKERS, SERPENTS, WHEELS,
ROMAN CANDLES, ROCKETS,

&c.

As also for some highly curious

AQUATIC FIREWORKS.

DERBY:
PUBLISHED BY THOMAS RICHARDSON;

WELLCOME
HISTORICAL
MEDICAL
LIBRARY

FIREWORKS.

Of the several Ingredients for making Fireworks.

Gunpowder.

GUNPOWDER being a principal ingredient in fireworks, it will not be improper to give a short definition of its strange explosive force, and cause of action, which, according to Dr. Shaw's opinion of the chemical cause of the explosive force of gunpowder, is as follows: "Each grain of powder, consisting of a certain proportion of sulphur, nitre, and coal, the coal presently takes fire upon contact with the smallest spark, at which time both the sulphur and the nitre immediately melt, and, by means of the coal interposed between them, burst into flame; which, spreading from grain to grain, propagate the same effect almost instantaneously, whence the whole mass of powder comes to be fired: and as nitre contains both a large portion of air and water, which are now violently rarefied by the heat, a kind of fiery explosive blast is thus produced, wherein the nitre seems by its aqueous and aërial parts, to act as bellows to the other inflammable bodies, (sulphur and coal,) to blow them into a flame, and carry off their whole substance in smoke and vapour.

Saltpetre.

Saltpetre is another principal ingredient in fireworks, and a volatile body: by reason of its aqueous and aëria. parts, it is easily rarefied by fire; but not so soon when foul and gross, as when purified from its crude and earthy parts, which greatly retard its velocity; therefore, it is necessary first to examine the saltpetre, and to see that it

be well cleansed from all impurities, and of a good sort, or your works will not have the proper effect.

Of Sulphur or Brimstone.

Sulphur is by nature the food of fire, and one of the principal ingredients in gunpowder, and almost in all compositions of fireworks; therefore, great care ought to be taken of its being good, and brought to the highest perfection. Now, to know when the sulphur is good, you are to observe that the sulphur is of a high yellow; and if when held in one's hand it crackles and bounces, it is a sign that it is fresh and proper for use. It is better to buy the flour ready made, as it is done in large quantities and in great perfection.

Charcoal.

Charcoal is a preservative, by which the saltpetre and brimstone are made into gunpowder, by preventing the sulphur from suffocating the strong and windy exhalation of the nitre. There are several sorts of wood made use of for this purpose; some prefer hazel, others willow, and others alder. The method of burning the wood is this: cut pieces of about two or three feet long, then slit each piece in four parts, scale off the bark and hard knots, and dry them in the sun or in an oven: then make in the earth a square hole, and line it with bricks, in which lay the wood, crossing one another, and set it on fire; when thoroughly lighted and in a flame, cover the hole with boards, and fling earth over them close, to prevent the air from getting in, yet so as not to fall among the charcoal: and when it has lain thus for twenty-four hours, take out the coals and lay them in a dry place for use. It is to be observed, that charcoal for fireworks must always be soft and well burnt, which may be bought ready done.

Method of preparing Gunpowder, Charcoal, and Brimstone, or Sulphur for making Fireworks.

Mealed gunpowder being so essential an article in the manufacture of fireworks, it is necessary to give proper directions for it. It should be reduced to such a degree of fineness, that not one grain shall be larger than another, or the fire can never be regular, nor can your work burn near so long; for if large grains are put into a case,

it explodes two or three times the quantity that would burn otherwise in a fair manner. Having laid your powder on a hard table, take a wooden muller (one made of lignum vitæ is the best,) and proceed to rub your powder till the grains are broken; then put it into a lawn sieve, and what will not pass through the sieve, return it to the table, and rub it till the whole passes through. Your powder will then be proper for mixing. Sulphur and charcoal must be done in the same manner.

Method of making Touch-Paper.

Dissolve, in spirits of wine or vinegar, a little saltpetre; then take some purple or blue paper, and wet it with this liquor, and when dry it will be fit for use. When you paste this paper on any of your works, take care that the paste does not touch that part which is to burn. The method of using this paper is by cutting it into slips, long enough to go once round the mouth of a serpent, cracker, &c. When you paste on these slips, leave a little above the mouth of the case not pasted; then prime the case with meal powder, and twist the paper to a point.

To Meal Gunpowder, Brimstone, and Charcoal

To meal these articles, a wooden mallet or a stone should be used, for were they to be done with an iron hammer, there would be danger of your powder exploding. You should spread your powder on a stone, and with your mallet you will soon reduce it to powder. Brimstone should be bought ready powdered; and charcoal may be pounded the same way as gunpowder, but for this an iron hammer may be safely used.

Steel or Iron Filings

Being used in fireworks to give a brilliancy to them, some observations on them may not be amiss. If your fireworks are to be used directly, you may use the filings without preparation; but if they are to be kept by you for a few months, or longer, the filings should be prepared.

To preserve Steel or Iron Filings.

The saltpetre being of a damp nature, it causes the iron to rust, the natural consequence of which is, that when the works are fired, there will appear but very few brilliant sparks, but instead of them a number of red and drossy

sparks; and besides, the charge will be weakened: but, to prevent such accidents, prepare your filings after the following manner: Melt in a glazed earthen pan some brimstone, over a slow fire, and, when melted, throw in some filings, which keep stirring about till they are covered with brimstone; this you must do while it is on the fire: then take it off, and stir it very quick till cold, when you must roll it on a board with a wooden roller, till you have broken it as fine as corn-powder: after which, sift from it as much of the brimstone as you can. There is another method of preparing filings, so as to keep two or three months in winter; this may be done by rubbing them between the strongest sort of brown paper, which has been before moistened with linseed oil.

If the brimstone should take fire, you may put it out by covering the pan close at top. It is not of much signification what quantity of brimstone you use, so that there be enough to give each grain of iron a coat; but as much as will cover the bottom will do.

Of mixing the several Ingredients.

The performance of the principal part of fireworks, depends much on the composition being well mixed; therefore great care ought to be taken in this part of the work, particularly in the composition for sky-rockets. First put the different ingredients together; then work them about with your hands, till you think they are pretty well incorporated; after which put them into a fine sieve, and after it is sifted, any remains that will not pass through the sieve, grind again till fine enough. Common works are not so material, nor need they be so fine. But in all fixed works, from which the fire is to play regularly, the ingredients must be very fine, and great care taken in mixing them well together; and observe, that in all compositions wherein are steel or iron filings, the hands must not touch; nor will any works, which have steel or iron filings in their charge, keep long in damp weather, without being properly prepared, according to the directions before given.

How to make all sorts of Moulds.

In the first place you must get the best dried box-wood you can, or if that cannot be procured, some other tough wood, such as crab-tree, holly, or such like wood. Hav-

ing decided on the height of your bore; say, for example, to have one bored of an inch high, which you can get bored by some turner: and to know of what length it must be, take for the said length, six diameters of the bore, which make six inches; and for the thickness, it must be half a diameter on each side, so that being turned round, it contains two inches in diameter. You must then provide a bottom, or foot, for the mould, which must be two diameters, or two inches in height, and one diameter and a quarter in breadth, whether the bottom be round or square. When you have made your mould, then you must fit your roller, which must be two third parts of the diameter of the bore of the said mould, and the length thereof to be six inches longer than your mould: this roller, which is for the rolling of your paper, must have a hole bored in the bottom to receive a wire, which wire must be fastened in another piece of wood somewhat shorter, which wire may be taken out at pleasure: this piece of wood may be as long as a person can hold conveniently in his hand; and which will be more plainly described in treating of rolling cases in the next chapter. When you have fitted your rockets according to this direction, proceed to the making of your rammers, of which there must be always two, at the least, to each mould: which rammer must be somewhat less than the roller, because otherwise, in putting it in, it will put down the paper, which is very prejudicial to your rocket.

The Method of rolling Cases for Rockets.

Having explained the manner and form of the mould and its dependants, we come now to treat of their use. 1st. *The use of the roller.* The cases must be made of good strong cartridge paper: cut this paper so, that it be one inch longer than the mould. Take your roller, and one length of paper, and begin to roll; when you have rolled one sheet, you must, in order to make your case as hard as possible, place it on some smooth table or board, hold your roller in your left hand, and the board in your right; roll it very hard one way, proceed so with every sheet, till it is of bigness enough to fill the mould very strait: when you have so done, draw forth your roller one inch, and then take the other part of the roller, which is short, and put it in; and thus you have a place left for the choking of your rocket.

How to choke a Rocket.

You must have a ring to screw into some post, to which ring you must tie your cord, which cord must be bigger or less according to the size of your rocket; for a small cord will not choke a great rocket, and *vice versa*, a great cord will not do for a small rocket; for it will make too great a choak: so you must have small cord and large cord. When you have provided yourself with these cords tie one end of your cord to the ring; and about a yard off tie the other end of the cord to a strong stick. Having twisted the cord, put the stick between your legs, and wind the cord about the rocket case, in the place appointed, which is between the long roller and the short; when you have so done, girt it by degrees, continually turning your roller, in order that it may come close and neat: when you have choked it sufficiently, draw forth your short roller, and where your choaking is, tie it about with strong pack-thread, and then drawing forth your long roller, you have a case ready to be filled when occasion requires.

For Rockets from one ounce to three.

Take only powder dust, well sifted, and fine, which rises swiftly, but it carries no tail. The ordinary quantity for small rockets, under four ounces, is, of

Powder, mealed, 1 lb. Saltpetre 2 oz. Coal-dust, or charcoal 2 oz.

Rockets of four ounces.

Meal-powder 1 lb. Saltpetre 4 oz. Charcoal 3 oz.

Rockets of eight ounces.

I. Meal-powder 1 lb. Saltpetre 4 oz. Brimstone 3 oz. Charcoal 1½ oz.

II. Meal-powder 1½ lb. Charcoal 4½ oz.

Rocket of one pound.

Meal-powder 2 lb. Saltpetre 8 oz. Brimstone 4 oz. Charcoal 2 oz. Steel-filings 1½ oz.

Sky Rockets in general.

I. Saltpetre 4 lb. Brimstone 1 lb. Charcoal 1½ lb.

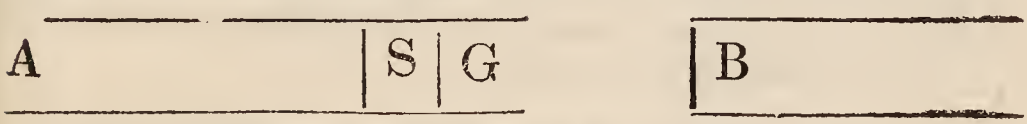
II. Saltpetre 4 lb. Brimstone 1½ lb. Charcoal 1 lb. 12 oz. Meal-powder 2 oz.

Crackers.

Cut some stout cartridge-paper into pieces three inches and a half broad, and one foot long; one edge of each of these pieces fold down lengthwise rather less than an inch broad, fold the double edge down a quarter of an inch, and turn the single edge back half over the double fold; then open it, and lay all along the channel, which is formed by the foldings of the paper, some meal-powder; then fold it over and over till all the paper is doubled up, rubbing it down every turn; this done, bend it backwards and forwards, two inches and a half, or thereabouts, at a time, as often as the paper will allow; then hold all these folds flat and close, and with a small pinching cord, give one turn round the middle of the cracker, and pinch it close; then bind it with packthread, as tight as you can; then, in the place where it was pinched, prime one end, and cap it with touch-paper. When these crackers are fired they will give a report at every turn of the paper; if you would have a great number of bounces, you must cut the paper longer, or join them after they are made; but if they are made very long before they are pinched, you must have a piece of wood with a groove in it, deep enough to let in half the cracker; this will hold it straight while it is pinching.

Waterloo Crackers.

Take a slip of cartridge-paper, about three-quarters of an inch wide, paste and double it; when it is quite dry, cut it into two equal lengths, as A and B in the pattern:



when you have proceeded thus far, glue or gum the paper slips in the parts marked G in the pattern, and on it strew a little powdered glass, or coarse (No. 1) emery; then put a grain of the silver on the part marked S, and while the glass composition is moist, put the paper marked A over the furthest row of glass. Over all, paste twice over the part that covers the silver a piece of paper; let it dry, and when you wish to explode it, take hold of the two ends, and pull them sharply from each other, and it will produce a loud report.

Water Crackers which turn in the Water.

The case is made nine or ten diameters long: the neck is drawn quite close, and charged with meal-powder almost half full; upon this a partition is made with a hole in it; then put corn-powder for a report; upon that is placed another partition; and the paper cut short at both ends. When these crackers are to be fired, make a touch-hole at the end of both, reversed. Having filled them up with meal-powder, and covered them well with brandy-dough, you may fire and fling them into the water, having previously dipped them in melted wax or pitch.

A Slow Fire

Must be composed of saltpetre four ounces, brimstone two ounces, and meal-powder one ounce and a half.

Dead Fire.

Saltpetre one ounce and a quarter, brimstone a quarter of an ounce, lapis calaminaris a quarter of an ounce, and antimony two drachms.

Brilliant Fir

Meal-powder one pound, saltpetre one ounce and a half, brimstone half an ounce, and steel-dust one ounce and a half.

For a Blue Flame.

Meal-powder, saltpetre, and sulphur vivum; the sulphur must be the chief part. Or, meal-powder, saltpetre, brimstone, spirits of wine, and oil of spike; but let the powder be the principal part.

Ingredients that make Sparks when rammed in Cases.

The set colours of fire produced by sparks are divided into four sorts, viz. the black, white, grey, and red. The black charges are composed of two ingredients, which are meal-powder and charcoal; the white of three, saltpetre, sulphur, and charcoal; the grey of three, meal-powder, charcoal, and saw-dust; and the red of four, meal-powder, sulphur, file-dust, and a small portion of charcoal.

Port or Wild Fires.

Saltpetre four ounces, meal-powder six ounces, and

brimstone two ounces. This composition must be moistened with one gill of linseed oil.

To make a Blue-Candle.

These cases are made much the same as for serpents, and are filled with a composition of a quarter of an ounce of saltpetre, half an ounce of powder, and one ounce of sulphur.

A very small quantity of charcoal may be added, which will have a sparkling effect.

To produce an explosion imitating Gunpowder.

Take a phial, which hold reversed the space of a minute over a bottle of solution of iron. Take away the phial, and afterwards put a lighted candle to its mouth, and you will see the effects.

To make a Catherine Wheel.

Take a piece of cartridge-paper, of what length you please, and roll it twice round a pretty thick wire, pasting it as you roll it; when the cases are dry, take the wire out, and fill it with a composition of slow fire such as follows:—one part of camphor, one part of saltpetre, one part of sulphur, and two parts of mealed-powder: after your cases are thus filled, you must twist it round a small wooden wheel, or a bone button-mould; and to fasten it at the end, you may either use sealing-wax, or what is much better, paste a piece of cartridge-paper across the Catherine wheel; when this is done, put a bit more of your composition to the mouth of your case, and fasten a bit of touch-paper to the end. When this is done, it is ready for use.

They may be made with half the above directed quantity of camphor.

How to make a Water Ball, which shall burn in the Water.

Having determined on the size of your ball, take the circumference and halve it, and of that make a circle, which cutting out in strong canvas shall be half a case, so that sewing two of them together they shall make a case. Having made your case proceed to the filling of it, which must be done thus:—First, put in three or four good spoonsful of your mixture, and then with a stick, made round at one end, force it close together, and so continue

filling it, and between every filling put in your stick and press it together, rounding it continually in your hand till such time as you have finished it; which having done, sew it up close, and then arm it with a small cord, which is called marling; after you have done that you must coat it with a quantity of rosin, pitch, and tallow dissolved, and dip your ball all over in the same, providing always that you leave two vents to fire it, which shall be pierced a third part into your ball, and must be stopped with small sticks, till such time as you come to use them; then pulling forth the stick, fill the two vents with fine powder dust, and firing it, cast it into the water, and you will have your desire. You must always let your ball be thoroughly fired before you cast it from you.

A Water Ball to throw up numerous Rockets in the Air.

Prepare a ball of wood of eight inches diameter, and bore a hole in the middle, of about an inch and a half, and let it come within an inch from the bottom; and about the great hole you must bore eight smaller holes, of the size of an inch, so that they be big enough to receive a rocket. These small holes should be an inch distant from the great hole, but they must all meet in one at the bottom; therefore you must cut off the bottom of the ball, and fit another to it, which may be so hollowed that your mixture may be conveyed to all the rockets; then fasten on the bottom (having filled it with your mixture), and put it into your two rockets, with the mouths downwards, passing paper round about them, which must be coated with rosin and tallow; and over each place where the rockets are placed, let the tallow be soaped over, in order that when it be fired the sparks may not easily take fire of the paper, which would make some confusion. Having done this, fit in a piece of wood to the greater bore of your ball, leaving only a smaller vent of half an inch, and by this means the fire will come out with more violence, and having spent itself within one inch of the bottom, it shall fire the eight rockets placed about, which by their force shall break the paper of each, and ascend into the air a small height, and after lie tumbling in the water.

Water Rockets.

Cases for these are made in the same manner as sky-rockets, only a little thicker of paper. When you fill

those which are drove solid, put in one ladleful of slow fire and then two of the proper charge, and on that two or three ladles of sinking charge, then the proper charge, then the sinking charge again, and so on till you have nearly filled the case; then drive on the composition a thin cake of clay, through which make a small hole to the charge; then fill the case with corn powder, on which turn down two or three rounds of the case in the inside; then pinch and tie the end very tight. Having filled your rockets (according to the above directions), dip their ends in melted rosin or sealing-wax, or else secure them well with grease. When you fill these rockets throw in six or eight at one time.

The following are the proper charges:

	lb.	*oz.*
Brimstone	0	4½
Saltpetre	1	0
Charcoal	0	6

Or the following—

Meal-powder	1	0
Saltpetre	4	0
Sea-coal	0	1
Charcoal	0	8½
Sulphur	0	1
Saw-dust	0	0¾
Steel-dust	0	9½

The proper charge for sinking Rockets—

Meal-powder	0	8
Charcoal	0	0¾

Water Rockets may be made from four ounces to five pounds.

Other curious Devices for the Water.

Those places near or where water is situated are suitable for the display of these devices; therefore when you wish to give your friends a specimen of your ingenuity, you can make figures of beasts, fishes or the like, spitting out fire as they run through the water. Among other designs which an inventive fancy can easily accomplish, is the representing of a castle, out of a door of which a dragon or any other animal may issue, by pulling a string; at the same time, by means of other strings, a horseman, or Neptune on a sea-horse, may advance to encounter the dragon.

The castle, or house, or tent, or what device may best please your fancy, should be made of light wire-work covered with oil-skin, and placed on a light wooden frame, which serves to support it in the water. This frame should be so balanced as to sink it sufficiently deep that it may not overset. When you construct the facing of your castle, which indeed is all that is necessary, you should contrive such a door at the water's edge as will, by pulling a string, open; and by pulling another the dragon must come out. Your horseman, or Neptune, must be supported in the like manner, and when it advances, by your pulling the string affixed to it, you should light one of the serpents which are put either on the turrets of the castle, or in one of its windows; upon this Neptune should seem to retreat, but presently afterwards again advance, and then several other of your serpents should be fired, and the dragon be made to advance, his nostrils and mouth also issuing out fire. You may by these few hints construct many other ingenious devices, and that too at a very trifling expense; one pennyworth of tin wire being more than sufficient for your castle, dragon, Neptune and all; and if oil-skin cannot easily be procured, stout oil-paper will make a substitute; or pasteboard oiled over will do for your Neptune and dragon. To light your squibs or serpents placed about the castle, you can use a long thin stick, with a bit of touch-paper at the end, which will easily communicate with the touch-paper of the fireworks. One remark, however, must be made: you must confine your device by a string, so that when you fire it, it may not run so far into the water as to be beyond your reach.

To make a Roman Candle.

The cases for Roman Candles may be made of any size but those of half an inch across the mouth, and in length about six inches, are as good as any. When you have made your cases, and choked them tight at one end, proceed to fill them. The charge for filling may be composed of three parts of saltpetre, two parts of brimstone, one part of meal-powder, and one part of finely-powdered glass; or four parts of saltpetre, two parts of brimstone, one part and a half of meal-powder, and one part of finely-powdered glass.

When you have finely powdered and well mixed either of those compositions, you can charge your cases; but in

doing this, observe the following directions; first put in a little mealed powder, and then a star, [directions for making the different stars are hereafter given; but they may be varied by any of the more brilliant fires before described,] on which ram lightly a ladleful of composition, then a little mealed powder, and on that a star; then again composition, and so on till you have filled the cases. Stars for Roman candles should not be round, but must be either square or flat and oval, with a hole through the middle; the quantity of powder for throwing the stars must increase as you come near the top of the case; for if much powder be put at the bottom it will burst the case. The stars must differ in size in this manner; let the star which you put in first be a little less than the bore of the case, but let the next star be a little larger, and the third star a little larger than the second, and so on let them increase in diameter till within two of the top of the case, which two must fit in tight. As the loading of Roman candles is somewhat difficult, it will be necessary to make two or three trials before you depend on their performance. When you fill a number of Roman candles, take care not to put in each an equal quantity of charge between the stars, so that when they are fired, they may not throw up too many stars at once.

Common Port Fires.

Port Fires are made of any length, but seldom more than twelve inches long. They are meant only to fire the works, their fire being very slow, and the heat of the flames so intense, that when applied to leaders, rockets, &c. it will fire them immediately. The cases for the common port fires must be rolled wet with paste, and one end pinched or folded down.

Proper Composition for a common Port Fire which must be moistened with one Gill of Linseed Oil.

	lb.	*oz.*
Saltpetre	0	12
Sulphur	0	4
Meal-powder	0	2

Or the following.	*lb.*	*oz.*
Saltpetre	1	2
Meal-powder	1	8
Sulphur	0	10

Pin Wheel.

First roll some paper pipes, about 14 inches long each; these pipes must not be made thick of paper, two or three rounds of elephant paper being sufficient. When your pipes are dried, you must have a thin tube 12 inches long, to fit easy into the pipes; at the end of this tube fix a small funnel; then bend one end of one of the pipes, and put the funnel in at the other as far as it will reach, and fill the cup with composition. Having filled some pipes, get some small blocks made about one inch diameter, and half an inch thick; round one of these blocks wind and paste a pipe, and to the end of this pipe join another; which must be done by twisting the end of one pipe to a point, and putting it into the end of the other with a little paste: in this manner join four or five pipes, winding them one upon the other, so as to form a spiral line. Having wound on four pipes, paste two slips of paper across them to hold them together; besides these slips of paper, the pipes must be pasted together.

There is another method of making these wheels, viz. by winding on the pipes without paste, and sticking them together with sealing-wax at every half turn: so that when they are fired, the end will fall loose every time the fire passes the wax, by which means the circle of fire will be considerably increased.

Charge.

	lb.	*oz.*
Meal-powder	0	4
Saltpetre	0	2
Steel-dust.....	0	1½

The appearance of these wheels may be heightened and varied, by occasionally putting in a spoonful of various coloured fires with the dead fire. The composition should be very dry, and not made too fine: they may be fired on a large pin, and held in the hand with perfect safety.

Mortars

Must be made of pasteboard, with a small bottom made of copper, in which the powder is to be placed, on which the balloon is to be put. In the centre of the bottom of this chamber make a small hole a little down the foot;

then putting a quick match, or touch-string of touch-paper into the hole, the mortar will be ready for firing.

Fiery Rain, or Peacock's Tail.

To represent a fiery rain falling from the rockets, mix among your charge a little composition of powdered glass, filings of iron, and saw dust. This shower is commonly called the peacock's tail, on account of the various colours that appear in it.

You may also exhibit a variety of colours issuing forth from a rocket, by mixing among the charge a little camphor, which produces a white or pale fire; rosin or strontium, a red and copper colour; bloodstone, which has been nealed, and beaten to an impalpable powder, will yield a blood red; sulphur, a blue; sal ammoniac, a green; raw antimony, a reddish or honey colour; ivory shavings, shining silver; filed agate stone, an orange; and pitch, a dark and deep-coloured fire. This must be discreetly managed; and practice will be the best teacher, as lessons perplex a young beginner.

The necks of your rockets must be drawn or choked firm, to prevent the cord giving way.

Prepare the composition for your rockets just before you want it.

Let it be neither too damp nor too dry, but sprinkle it over with a little oily substance, or a little brandy.

And always avoid, if possible, a damp, foggy, rainy, or windy night to display your rockets.

A Composition for Stars of a beautiful colour, to put in Rockets, Serpents, Blue-Candles, Water-Rockets, or other Fireworks.

Saltpetre, 1 ounce; sulphur vivum, 1 ounce; camphor, a quarter of an ounce; beat these very fine, and mix them: afterwards make them up into paste with oil of turpentine, and form these into small balls about the size of peas, roll these in powder dust, and let them dry. Of this sort, you may put one, two, or three dozen into a rocket, and other fireworks of a similar sort or size; and they will have a very pretty effect. To fireworks of a smaller sort, a less quantity must of course be used.

Squibs, or Serpents.

Squibs or serpents for common use are made from 2¼

inches to 7 inches long, they are rolled and choked like the cases for port fires, and well pinched at both ends, sealing the bottom with wax. Put in about half a thimble-full or more according to the size of your squib, of corn-powder, and ram it well down, then fill it up with the following:—Charge, meal-powder 1lb.; charcoal 1 oz.; steel-filings 1 oz.

Ram it down two or three times in filling. When full, paste touch-paper round the top, and pinch it up after priming it.

Ditto Larger.

First make the cases of about six inches in length, by rolling slips of stout cartridge-paper three times round a roller, and pasting the last fold; tying it near the bottom as tight as possible, and making it air-tight at the end by sealing-wax. Then take of gunpowder half a pound; charcoal 1 ounce; brimstone 1 ounce; and steel-filings half an ounce, (or in like proportion) grind them with a muller, or pound them in a mortar. Your cases being dry and ready, first put a thimble-full of your powder, and ram it hard down with the ruler; then fill the case to the top with the aforesaid mixture, ramming it hard down in the course of filling two or three times; when this is done, point it with touch-paper, which should be pasted on that part which touches the case, otherwise they are liable to drop off.

Water Squibs.

Water squibs are generally made of one ounce serpent cases, seven or eight inches long, filled two-thirds with charge, and the remainder bounced; the common method of firing them is thus:—Take a water-wheel, with a tin mortar in its centre, which load with squibs after the usual method, but the powder in the mortar must be no more than will just throw the squibs out easily into the water; you may place the cases on the wheel, either obliquely or horizontally; and on the top of the wheel, round the mortar, fix six cases of brilliant fire, perpendicular to the wheel; these cases must be fired at the beginning of the last case of the wheel, and the mortar at the conclusion of the same.

Wildfire that will burn under Water.

This is composed of equal quantities of sulphur, nep-

tha, bitumen, pitch and gum; and can only be extinguished by vinegar mixed with sand and urine, or by covering it with raw hides.

Balloons.

Having made some thin paper shells, of what diameter you please, fill some with the composition for water balloons, and some after this manner: having made the vent of the shells pretty large, fill them almost full with water-rockets, marroons, squibs, &c. Then put in some blowing-powder, sufficient to burst the shells; and afterwards fix in the water rocket, long enough to reach the bottom of the shell, and its neck to project a little out of the vent; this rocket must be open at the end, to fire the powder in the shell, which will burst the shell, and disperse the small rockets, &c. in the water. When you have well secured the large rocket in the vent of the shell, take a cork float with a hole in its middle, which fit over the head of the rocket, and fasten it to the shell: this float must be large enough to keep the balloon above water.

Odoriferous Balloons.

These balloons are made in the same manner as the former, but very thin of paper, and in diameter one inch, with a vent with half inch diameter. The shells being made, and quite dry, fill them with either of the following compositions, which must be rammed in tight: these balloons must be fired at the vent, and put into a bowl of water. Odoriferous works are generally fired in rooms.

Compositions.—Saltpetre 3lb. 2 oz.; flour of sulphur 1 oz.; camphor $\frac{1}{2}$ oz; yellow amber $\frac{1}{2}$ oz.; charcoal dust $\frac{3}{4}$ oz.; flour of Benjamin, or Assa Odorata $\frac{1}{2}$ oz.; all powdered very fine and well mixed, and moistened with oil of spike; or, saltpetre 12 oz.; meal-powder 3 oz.; Frankincense 1 oz.; Myrrh $\frac{1}{2}$ oz.; charcoal 3 oz.; all moistened with the oil of spike or roses.

Fire Fountains.

To make a fire fountain you must have a float made of wood, three feet diameter; then in the middle fix a round perpendicular post, four feet high and two inches diameter; round this post fix three circular wheels made of thin wood, without any spokes. The largest of these wheels must be placed within two or three inches of the float, and must be

nearly of the same diameter. The second wheel must be 2 feet 2 inches diameter, and fixed at two feet distance from the first. The third wheel must be 1 foot 4 inches diameter, and fixed within 6 inches of the top of the post; the wheels being fixed, take eighteen 4 or 8 oz. cases of brilliant fire, and place them round the first wheel with their mouths outwards, and inclining downwards; on the second wheel place thirteen cases of the same, and in the same manner as those on the first; on the third, place eight more of these cases, in the same manner as before, and on the top of the post fix a gerbe; then clothe all the cases with leaders, so that both they and the gerbe may take fire at the same time.

A Mermaid, &c. to play and swim upon the Water.

You may make figures of what shape your fancy best pleases; the body must be made of light wicker rods, and in the midst of the body let there be placed an axle-tree, having two wheels coming into the water, yet so as they may not be seen; these wheels must be hollow, to contain a quantity of sand or water; the use of it is to keep the body of your figure upright, and able to sink it so far into the water as is needful, and likewise to make it swim more steadily; note that these wheels must be loose, and the axle-tree fast; in the midst of this axle-tree place three or four great serpents one by another, with their mouths all one way; yet so order it that there may be such a distance between each serpent, as there may come a vent from the tail of the first to the mouth of the second, and from the second to the third. And to the end that it may continue the longer in motion, you may place divers lights about the body, to make it more beautiful; every one of these lights extinguishing should give a report, and so conclude. There are divers other fireworks to be performed on the water, which any ingenious person may invent.

Horizontal Wheels.

First get a large wooden bowl without a handle; then have an octagon wheel made of flat board 18 inches diameter, so that the length of each side will be near 7 inches; in all the sides cut a groove for the cases to lie in. This wheel being made, nail it on the top of the bowl; then take four 8 oz. cases filled with a proper charge, each about 6 inches in length. Now, to clothe the wheel with cases, get some whitish brown paper, cut it into slips 4 or 5 inches

broad, and 7 or 8 long: these slips being pasted all over on one side, take one of the cases, and roll one of the slips of paper about $1\frac{1}{2}$ inch on its end, so that there will remain about $2\frac{1}{2}$ inches of the paper hollow from the end of the case; this case must be on one of the sides of the wheel, near the corners of which must be holes bored, through which you put the packthread to tie the cases; having tied on the first case at the neck and end, put a little mealed powder in the hollow paper; then paste a slip of paper on the end of another case, the head of which put into the hollow paper on the first, allowing a sufficient distance from the tail of one to the head of the other, for the pasted paper to bend without tearing; the second case tie on as you did the first, and so on with the rest, except the last, which must be closed at the end, unless it be to communicate to any thing on the top of the wheel, such as fire pumps, or brilliant fires, fixed in holes cut in the wheel, and fired by the last, or second case, as fancy directs; six, eight, or any number may be placed on the top of the wheel, provided they be not too heavy for the bowl.

Before you tie on the cases, cut the upper parts of all their ends, except the last, a little shelving, that the fire from one may play over the other, without being obstructed by the case. Wheel-cases have no clay drove in their ends, nor pinched, but are always left open, only the last, or those which are not to lead fire, which must be well secured.

Tailed Stars.

These are called tailed stars because there are a great number of sparks issue from them, which represent a tail like that of a comet. Of these there are two sorts, rolled and drove; when rolled, they must be moistened with a liquor made of half a pint of spirit of wine, and half a gill of thin size, of this use as much as will wet the composition enough to make it roll easy; when they are rolled, sift meal-powder over them, and set them to dry.

When tailed stars are drove, the composition must be moistened with spirits of wine only, and not made so wet as for rolling; 1 and 2 oz. cases rolled dry, are best for this purpose, and when they are filled unroll the case within three or four rounds of the charge, and all that you unroll cut off: then paste down the loose edge, two or three days after the cases are filled, cut them in pieces 5 or 6-8ths of an inch in length; then melt some wax, and dip

one end of each piece into it, so as to cover the composition: the other end must be rubbed with meal-powder wetted with spirits of wine.

Drove Stars.

Cases for drove stars are rolled with paste, but are made very thin of paper. Before you begin to fill them, damp the composition with spirit of wine that has had some camphor dissolved in it; you may ram them indifferently hard, so that you do not break or sack the case, to prevent which they should fit tight in the mould. They are drove in cases of several sizes, from 8 drachms to 4 oz. When they are filled in $\frac{1}{2}$ oz. cases, cut them in pieces of $\frac{3}{4}$ of an inch long; if 1 oz. cases, cut them in pieces of 1 inch; if two oz. cases, cut them in pieces $1\frac{1}{4}$ inch long; and if 4 oz. cases, cut them in pieces of $1\frac{1}{2}$ inch long: having cut your stars of a proper size, prime both ends with wet meal-powder. These stars are seldom put in rockets, being chiefly intended for balloons, and drove in cases, to prevent the composition from being broken by the force of the blowing powder in the shell.

Strung Stars.

First take some thin paper, and cut it into pieces of $1\frac{1}{2}$ inch square, or thereabouts; then on each piece lay as much dry star-composition as you think the paper will easily contain; then twist up the paper as tight as you can; when done, rub some paste on your hands, and roll the stars between them; then set them to dry; your stars being thus made, get some flax or fine tow, and roll a little of it over each star; then paste your hands and roll the stars as before, and set them again to dry; when they are quite dry, with a piercer make a hole through the middle of each, into which run a cotton quick-match, long enough to hold ten or twelve stars, at 3 or 4 inches distance; but any number of stars may be strung together by joining the match.

To make a Fire Balloon.

Take eight sheets of paper, either India, bank-post, or stout tissue; cut each sheet in an oblong round form, and with good paste, join the broad parts together; then paste the edges of the whole together, leaving the bottom part open to serve as a neck or mouth; when you have done

this if you can perceive any little hole in any of the seams, or other part of your balloon, cover it neatly over, and let it hang over a line to dry in the air; or, if in a room, not too near to the fire. When it is quite dry, paste a bit of thin wire round the bottom of the neck or mouth to keep it open, and put four cross wires, on the middle of which place your piece of sponge; then get half a gill of spirits of wine, dip your sponge into it and set fire to what remains in your cup, hold the mouth of the balloon over the spirits of wine, taking care not to hold it so close as to set fire to it; when you think it is filled enough, place your sponge in your wires, and set fire to that, and you will see your balloon ascend in a regular and pleasing manner. While the sponge in the mouth of the balloon continues to burn, it will, by preventing the air from mixing with the gas, continue to ascend, but as soon as it becomes weakened, or expires, it will descend. To prevent its descending too soon, you should place your sponge some little way into the mouth or neck of your balloon; by which means, it will keep up so long as the spirits of wine continue to have the least strength.

To make Thunder Powder.

This is done with three ingredients, namely, three parts saltpetre, two parts salt of tartar, and one part of sulphur; these are pounded and mixed together. If you take about six grains in a spoon, and warm it over a candle or fire, it will give a report like a cannon.

Marroons.

Formers of marroons, are from three-quarters of an inch to one and a half diameter; cut the paper for the cases twice the diameter of the former board, and long enough to go three times round; when you have rolled a case, paste down the edge, and tie one end close; then with the former drive it down to take away the wrinkles and make it flat at bottom; then fill the case with corn powder one diameter and a quarter high, and fold down the rest of the case tight on the powder. The marroon being thus made, wax some strong packthread with shoemaker's wax, this thread wind up into a ball; then unwind two or three yards of it, and that part which is near the ball, make fast to a hook; then take a marroon and

stand it as far from the hook as the packthread will reach, and wind it lengthwise round the marroon, as close as you can, till it will hold no more that way ; then turn it, and wind the packthread on the short way, then lengthwise again, and so on till the paper is all covered ; then make fast the end of the packthread, and beat down both ends of the marroon, to bring it in shape. The method of firing marroons is, by making a hole at one end with an awl, and putting in a piece of quick-match ; then take a piece of strong paper, in which wrap up the marroon, with two leaders, which must be put down to the vent, and the paper tied tight round them with small twine ; these leaders are bent on each side, and their loose ends tied to other marroons, and nailed in the middle of the rail of the stand. The use of winding the packthread in a ball is, that you may let it out as you want it, according to the quantity the marroon may require, and that it may not be tied in knots, which would spoil the marroon.

To prepare a Globe which burns like a Star, and leaps about both on Land and in the Water.

Cause a globe to be turned of dry wood, whose diameter is the length of a half-pound or pound rocket. Divide this globe into two equal parts; in the middle of one of the half globes, in the inside, make a cavity, deep, long, and wide enough to hold three or four crackers, so that the other half of the globe may be easily and closely fitted upon them. After this, take three serpents, one with strong reports, and two without any. Place them so into the hollow, that the head of the one may lay on the other's neck, and be so ordered, that as soon as the one is spent, the other may take fire and force the globe back; and thus alternately from one to the other till it comes to the report, which finishes. Care must be taken that the fire passes not from the first to the next serpent before it has quite consumed the first.

Having taken care to fix the serpents, cover them with the other half globe, and join them firmly with strong pasted paper.

Printed by Thomas Richardson, Derby.

RICHARDSON'S
LIST OF
PAMPHLETS, SONG BOOKS,
&c.

PAMPHLETS,

With beautiful coloured folding frontispieces, 6d. each.

Art of Legerdemain.
Bamfylde Moore Carew.
Baron Munchausen's Travels.
Buonaparte's Book of Fate.
Comical Budget of Fun and Frolic.
Cook, the Murderer.
Doctor Faustus.
Domestic Cookery, or the Housewife's Sure Guide.
Dream-book.
Dutchess of C——.
Gentleman's Valentine Writer.
George Barnwell.
Hoggart, the Murderer.
Jane Shore.
Lady's Valentine Writer.
Mary, the Maid of the Inn.
Nixon's Prophecies.
Norwood Gipsy.
True Lover's Own General Valentine Writer.
Turpin, the Highwayman.

SONG BOOKS.

PAMPHLET SONG BOOKS,

With beautiful coloured folding frontispieces, 6d. each.

Choice Songster.
Fashionable Songster.
New London Songster.
New Modern Minstrel.
New Universal Songster; or, Sportman's Companion.
Songster's Companion; or, Comical Budget.

WARBLERS,

With coloured folding frontispieces, 6d. each.

Comic and English Songbook.
Favourite New English Songs.
Little English Warbler.
New English Warbler.
New Collection of English Songs.
Popular English Songs.

SONG BOOKS,

With coloured frontispieces and titles, 6d. each.

The Nightingale.
The Skylark.
The Thrush.

Gentleman's New Fashionable Letter-Writer, 6d.
Lady's New Fashionable Letter-Writer, 6d.
Lady's and Gentleman's New Fashionable Letter-Writer, 1s.
Hoyle's Games; containing Whist, Chess, Draughts, and Back-Gammon, with the last new Rules established at London and Bath, 1s.